FPL

10 CFR § 50.73
L-2005-268
December 22, 2005

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: Turkey Point Unit 4
Docket No. 50-251
Reportable Event: 2005-005-00
Date of Event: October 31, 2005
Loss of Offsite Power Causes Engineered Safety Feature Actuations

The attached Licensee Event Report 50-251/2005-005-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv)(A).

If there are any questions, please call Mr. Walter Parker at (305) 246-6632.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
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| Turkey Point Unit 4 | 05000251 | 1 OF 6 |

**4. TITLE**

Loss of Offsite Power Causes Engineered Safety Feature Actuations

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |
| 10 | 31 | 2005 | 2005 | - 005 - | 00 | 12 | 22 | 2005 | FACILITY NAME | DOCKET NUMBER 05000 |

**9. OPERATING MODE**

3

**10. POWER LEVEL**

0

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)***

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

**12. LICENSEE CONTACT FOR THIS LER**

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Paul F. Czaya – Licensing Engineer | 305-246-7150 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

**14. SUPPLEMENTAL REPORT EXPECTED**

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

| 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|
| | | | |


ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On October 31, 2005 at approximately 2227 hours, Unit 4 was in Mode 3 hot standby when the 240 kV switchyard protective relays actuated causing a loss of offsite power (LOOP) to the Unit 4 startup transformer. Unit 3 was in Mode 1 at about 60% power at the time and was unaffected by the LOOP to Unit 4. As expected, the Auxiliary Feedwater System actuated, steam generator blowdown isolated and the emergency diesel generators started and loaded their respective electrical buses (4A and 4B). The 4C bus remained energized during the event. Natural circulation was established and decay heat removal was via atmospheric steam dump valves. The cause of this event is a failure to identify the extent of salt contamination due to hurricane Wilma on the 240 kV switchyard line insulators that resulted in untimely maintenance. The insulators were cleaned and the startup transformer was returned to service. Long term corrective actions include: 1) the line insulators will be incorporated into the System Performance Monitoring Program, 2) the switchyard insulators will be replaced with resistive glazed insulators with priority given to replacing the insulators associated with nuclear startup transformers, 3) a second remote contamination monitor (RCM) will be installed in the PTN switchyard, and 4) grid operations procedures will be revised to verify functionality of the RCMs and to perform swipe checks on the test insulator if an RCM is found defective or there is any other indication of abnormality. As all systems required to respond to the LOOP actuated as designed, the health and safety of the public and plant personnel were not affected.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

DESCRIPTION OF THE EVENT

On October 31, 2005 at approximately 2227 hours, Unit 4 was in Mode 3 hot standby when the 240 kV switchyard protective relays [FK, RLY, 87] actuated causing a loss of offsite power (LOOP) to the Unit 4 startup transformer [EB, XFMR, XPT]. As expected, the Auxiliary Feedwater (AFW) System [BA] actuated, steam generator [SB, SG] blowdown isolated and the emergency diesel generators (EDG) [EK, DG] started and loaded their respective electrical buses (4A and 4B) [EB, BU]. The 4C bus remained energized during the event. Natural circulation was established and decay heat removal was via atmospheric steam dump valves [KE, V]. There were no inoperable structures, systems or components at the start of the event that contributed to the event.

Unit 4 reactor coolant system (RCS) [AB] temperature and pressure were approximately 390°F and 700 psig, respectively, at the onset of the LOOP. Unit 3 was in Mode 1 at about 60% power at the time and was unaffected by the LOOP to Unit 4.

The 240 kV string bus differential relay sensed a line-to-ground fault in the switchyard resulting in the loss of the Unit 4 startup transformer. Backup offsite power was available from the 4C bus transformer and the Unit 3 startup transformer, but was not required as the Unit 4 EDGs responded as designed.

An unusual event was declared due to the LOOP. The unusual event and engineered safety feature actuations were reported to the NRC in Event Report No. 42104. Condition Report No. 2005-29696 was initiated to evaluate the event, and determine cause and corrective actions. This event was determined to be reportable as a License Event Report in accordance with 10 CFR 50.73(a)(2)(iv)(A).

BACKGROUND

The electrical design of Units 3 and 4 at Turkey Point is based on the principle that each unit be self-sufficient to the extent practicable, considering shared systems/components, and have adequate auxiliary equipment to meet emergency conditions. The electrical system has been designed to provide sufficient normal and emergency auxiliary electrical power to assure the capability for a safe and orderly shutdown as well as to maintain the units in a safe condition under all credible circumstances.

Each of the two units has an auxiliary transformer [EL, XFMR, XPT] connected to the generator isolated phase bus [EL, BU, IPBU] to serve as the normal source of auxiliary electrical power. The auxiliary and C bus transformers are capable of supplying the electrical power requirements associated with its unit as well as those requirements common to both units.

In addition to the unit auxiliary transformers, there are two startup transformers, one for each unit. The startup transformers are connected to the 240 kV buses on their primary sides and have two secondary windings at 4.16 kV. The startup and C bus transformers serve the unit during startup, shutdown, and after a unit trip. The C bus transformers are isolated from their respective startup transformer. The startup transformer also constitutes a standby source of auxiliary power in the event of the loss of the unit auxiliary

transformer during normal operation. In the event of a turbine [TA, TRB] trip, an automatic transfer connects the A and B 4.16 kV buses to the unit startup transformer.

Each startup transformer has the capability of being connected to different 240 kV buses. In the event of a 240 kV bus fault, at least one startup transformer could be quickly restored to service. The Unit 3 startup transformer is normally connected to the northeast and southwest switchyard bus. The Unit 4 startup transformer is normally connected to both the southeast and southwest switchyard buses. Thus, a 240 kV bus fault will not result in the loss of a startup transformer.

The unit auxiliary transformer can be isolated by means of removable links in the connection to the generator bus. The startup transformer for the adjacent nuclear unit is available as a redundant source of emergency power. A 4.16 kV tie is provided from the "Y" secondary winding of each startup transformer to provide emergency power to the 4.16 kV A bus of the adjacent nuclear unit as a redundant offsite power source.

In the event of a loss of the preferred power sources, the onsite EDGs and station batteries [EJ, BTRY] supply power.

## CAUSE OF THE EVENT

The cause of this event is a failure to identify the extent of salt contamination on the 240 kV switchyard line insulators [FK, INS] that resulted in untimely maintenance. Hurricane Wilma on October 24, 2005 was the most likely cause of salt accumulation on the line insulators. Although contaminated with salt, the *insulators* performed as designed for six days after Wilma until atmospheric conditions changed to cause the flashover on October 31, 2005.

## ANALYSIS OF THE EVENT

The event was self-revealing.

On October 31, 2005, the 240 kV switchyard protective relays actuated causing a LOOP to the Unit 4 startup transformer. The switchyard is located in an environment susceptible to marine salt contamination. Line insulators are station post standard porcelain glaze types of 1970s vintage. Utility experience suggests that regular insulator cleaning is not required since rainfall will wash the insulators. Salt contamination level and cleaning decisions are normally assessed using a combination of weather monitors (rainfall), morning contamination reports, early morning condition assessment (amount of flashover, location of flashover, type of insulator), indications from a remote contamination monitor (RCM), and from swipe tests. The line insulators associated with the Unit 4 startup transformer were last cleaned in February 2004, and there was limited indication they needed cleaning.

The Turkey Point Power Plant is located on the shores of Biscayne Bay, which is salt seawater. On October 24, 2005, winds from hurricane Wilma drove seawater onto the site from Biscayne Bay, but, since the storm backside was small, it did not bring heavy rain to wash the insulators as would be expected of a typical hurricane. As forecasted, there was a period of dry and cool weather after the storm with winds from the southeast. While there were no significant visual precursors to flashover after the storm, it was recognized that an insulator in a dry environment, even if heavily contaminated, would not produce a significant amount of flashover. Since the usual triggers for action had not yet been met and there was considerable effort focused on restoring power to customers due to the damage caused by hurricane Wilma, there was no urgency in redirecting Florida Power and Light (FPL) crews from that effort in support of an insulator cleaning task. A cleaning contractor was hired since it was felt to be a conservative decision in spite of clean readings from the RCM and a reported modest level of observed flashover. The contractor cleaning crew arrived on site on the afternoon of October 31, 2005 and immediately started cleaning the northwest bus that had shown the most flashover activity during the latest visual morning assessment.

On the evening of Monday, October 31, 2005, the ambient dew point increased and the porcelain insulators cooled off as a light rain began to fall. Subsequently, the switchyard experienced several insulator flashovers to ground. The loss of the Unit 4 startup transformer was the result of tripping of the 240 kV string bus differential relay, which sensed one of those line-to-ground faults.

A swipe check on a test insulator was performed one day after the flashover event. The test showed an Equivalent Salt Deposition Density that, for the present insulator types and given similar circumstances, was sufficiently high as to overcome insulation capability and cause flashover. Additionally, the wind speed indicator [IS, SI] in the RCM was discovered broken three days after the flashovers. A broken speed input to the RCM program would sense low wind speed, and, as a product of the internal algorithm, the RCM would provide a low contamination reading. As a result, the dry weather and faulty RCM indication masked the potential for flashover.

Reportability

A review of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73 and NRC guidance provided in NUREG-1022, Revision 2, Event Reporting Guidelines 10 CFR 50.72 and 10 CFR 50.73, was performed for the subject condition. As a result of this review, the condition is reportable as described below.

10 CFR 50.73(a)(2)(iv)(A) requires a report of "Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section...." 10 CFR 50.73(a)(2)(iv)(A) lists exceptions that do not apply to this event. The systems listed in 10 CFR 50.73(a)(2)(iv)(B) include the AFW system and EDGs, which actuated upon the LOOP. In addition, a report (42104) was made in accordance with 10 CFR 50.72(b)(3)(iv)(A) at the time of the event. The LOOP also met the reporting requirements for declaration of an unusual event, which was included in Report 42104.

ANALYSIS OF SAFETY SIGNIFICANCE

With Unit 4 in Mode 3, both Unit 4 EDGs started and loaded onto their respective buses in response to the LOOP. The AFW system also actuated, as designed. The AFW system was subsequently secured and secondary side steam generator inventory was maintained by the A standby steam generator feedwater pump (SSGFP) [SJ, P]. The A SSGFP is powered from the 4.16 kV C bus, which did not lose power. Decay heat removal was accomplished by a combination of natural circulation and residual heat removal (RHR) system [BP] operation and the atmospheric steam dump valves. This method was utilized to reduce RCS temperature, within cooldown limits, to enter Mode 5. With no operable reactor coolant pumps [AB, P] due to the LOOP, Technical Specification (TS) 3.4.1.2, Action a requires the unit to be in hot shutdown (Mode 4) within 12 hours. Unit 4 reached Mode 4 at approximately 0805 hours on November 1, 2005. TS 3.4.1.3, Action a requires the unit to be in cold shutdown (Mode 5) within 24 hours of reaching Mode 4. Mode 5 was achieved at approximately 1805 hours on November 1, 2005. The Unit 4 startup transformer was returned to service at approximately 0105 hours on November 2, 2005. The transfer of loads to the startup transformer and shutdown of the EDGs was completed at approximately 0122 hours on November 2, 2005.

The 4.16 kV C bus was available to supply Unit 4 loads, as were both Unit 4 EDGs. The EDGs operated for the duration of the event for power supply to their respective safety buses. The RHR and AFW systems and SSGFPs were available to provide decay heat removal during the LOOP. At the time of the event, the emergency core cooling high head safety injection system [BQ] was operable as were containment cooling [BK] and filtering [VA] systems should they have been needed.

Two challenges complicated the plant cooldown to Mode 5. One challenge involved the inability to reduce RHR flow to ensure the RCS cooldown limit was not exceeded. This was due to excessive flow control valve [BP, FCV] leak-by and necessitated the operating RHR pump to be shutdown and restarted several times. The decay heat load was relatively low due to the unit's shutdown for hurricane Wilma a week prior and loss of added heat from the RCPs when they lost power due to the LOOP. The low decay heat contributed to the need to cycle the RHR pump.

The second challenge concerned the TS limit on pressurizer [AB, PZR] spray water temperature differential. While placing Unit 4 RHR in service and utilizing auxiliary spray to cool the pressurizer, it was observed that the temperature differential between the spray water and pressurizer exceeded the TS LCO 3.4.9.2.c limit of 320°F for approximately 6 1/3 hours. For an out-of-limit condition, the TS Action requires, among other actions, an Engineering Evaluation to determine the effects on the structural integrity of the component. The evaluation concluded that there was no adverse impact on the structural integrity of the pressurizer.

As all appropriate systems actuated as designed in response to the LOOP and as the plant was brought to cold shutdown as required by the TSs, there was no impact on plant safety.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

CORRECTIVE ACTIONS

Initial Actions

1. The insulators were cleaned.
2. The remote contamination monitor was repaired and returned to service.

Long Term Actions

1. The line insulators will be incorporated into the System Performance Monitoring Program.
2. The switchyard insulators will be replaced with resistive glazed insulators with priority given to replacing the insulators associated with the nuclear startup transformers. The resistive glazed insulators are less prone to flashover from salt deposit by several orders of magnitude when compared to existing standard insulators.
3. A second RCM will be installed in the PTN switchyard.
4. Grid operations procedures will be revised to verify functionality of the RCMs and to perform swipe checks on the test insulator if an RCM is found defective or there is any other indication of abnormality.

ADDITIONAL INFORMATION

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE system identifier, component function identifier, second component function identifier (if appropriate)].

FAILED COMPONENTS IDENTIFIED: None

SIMILAR EVENTS: There is a considerable amount of industry experience regarding contamination impacts on electrical insulators in power plant switchyards. However, no similar event has occurred at Turkey Point.